

Tapping into **Maple Tradition**

Follow-up lessons for "Sugarbush Spring" by Marsha Wilson Chall

Maple Password: (grades 2-6) Oral and written communication, mathematical representation plus physical and conceptual models to describe and explain scientific concepts and ideas.

Fit To Be Thinned: (grades 3-6) Students will use inquiry strategies to investigate and understand the natural world.

ABC Sugarbush: (grades 1-2) Students will learn to use the process approach to writing coherently and using appropriate conventions.



LESSON #1 MAPLE UNIT

Maple Password

Taken from Shelbourne Farms - *Project Seasons*

Subject: Science, Language

Objectives:

- *Review and understand Maple Sugaring vocabulary
- *Students will use oral and written communication, mathematical representation, and physical and conceptual models to describe and explain scientific concepts and ideas, and will be able to apply scientific and technical knowledge.

Grade Level: Grade 2 - 6

Length of Lesson: 20 minutes for Password, plus time for creating the “Maple Sugaring Dictionary”

Overview: Students will create a class “Maple Sugaring Dictionary.” Break the children into groups before beginning the lesson and assign each group several letters of the alphabet..

Materials:

- Paper
- Two Envelopes
- Index cards
- Teacher Sheet with Vocabulary Words



Activity:

1. Ask each group to brainstorm a list of words related to sugaring for each of their letters. Challenge the groups to create the most complete sugaring dictionary as possible. Have the kids either read books, log onto the internet or ask a local maple producer to help make the list complete.
2. When the lists are complete, ask each group to define their words. Let them be responsible for alphabetizing and writing up their pages in the dictionary. (For older children have them refer to standard dictionaries as a guide for a format). Give the students time to look through the completed class dictionary.
3. Now the class is ready to play a game of MAPLE PASSWORD. Divide the students into 2 teams and have them quickly review their sugaring vocabulary.
4. As they are reviewing, select several words from their dictionary and write each word on 3 separate index cards. Place 2 of the index cards into two separate envelopes. Ask each team to further divide themselves into pairs. Have the first pair from each team come forward and sit in 4 chairs at the front of the classroom.

LESSON #1-MAPLE UNIT

Maple Password - Continued

5. Explain that during each round, both teams will receive the same vocabulary word. One person from each pair will see the vocabulary word. They will take turns giving one word clues to their partners to help them guess the word. Let the students decide which of the pair will see the word and who will give the clues. Have the students who are guessing the words turn their backs to the class and have the other 2 come forward.
6. Pass these students an envelope with the word written inside. Show the “audience” the same word written on the 3rd index card. Remind them they must remain silent. When everyone has seen the word, collect the envelopes and place all 3 cards in a paper bag. Now have the team members sit side-by-side facing the audience to begin the game.
7. Choose a team to begin giving the clues. (The teams alternate giving clues until the word is guessed.) Remind them that they have the same word and should listen closely to the other team’s clues and guesses because it can help them.
8. The first team to guess the word receives a point. The game continues with the next pair from each team repeating the process with a new word. The team that won the last round gets to choose who will give the first clue.

Extension:

Make a set of flat paper buckets that are strung with string to be worn around the students’ necks. On half of the bucket cards, write a sentence which uses one of the vocabulary words from the kids Maple Sugaring Dictionary. Leave a blank in the sentence where the word belongs. On the remaining cards, write the missing words. Distribute all the buckets and explain that each student must find the student with the word that completes the sentence properly. For older students place the buckets on the students backs and have them work as a group to pair each other up. Then let the “word” student guess their word and fill in the blank as they read the sentence on their partner’s back.

Additional Resources:

Vermont Ag in the Classroom Maple Unit: www.vt-aitc.org

Maple Producer’s website : www.nhmapleproducers.com

Vermont Maple Producer’s website: www.vermontmaple.org

LESSON #1—MAPLE UNIT

TEACHER BACKGROUND SHEET

MAPLE SUGARING VOCABULARY WORDS

*Try to make sure that these words are included in the dictionary.

Arch—The portion of the evaporator beneath the pans in which the fire is built.

Aproning

Boil

Bucket

Collect

Drill

Evaporator

Filter

Fire

Hammer

Grading Set

Hydrometer

Maple tree

Metal bucket

Mokuk - A birch bark container used by Native Americans to hold maple sugar.

Pan

Pancakes

Pipeline

Reverse Osmosis

Sap

Sheeting

Sinzibuckwud - The Algonquin word for maple syrup, meaning “drawn from wood.”

Spile

Spring

Sugar Bush

Sugarhouse

Sugar sand

Sugar maker

Syrup

Tap

Tap Hole

Temperature

Vacuum Pumps

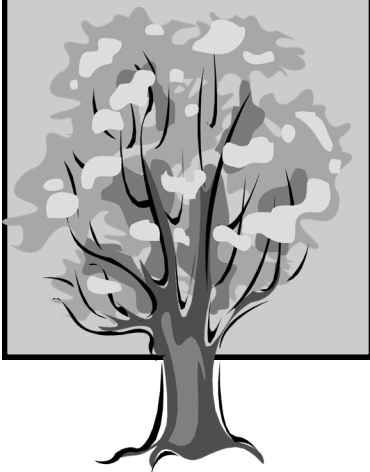
LESSON #2 MAPLE UNIT

Fit To Be Thinned

Taken from Shelbourne Farms - “*Project Seasons*”

Materials:

- Tree Identification Card. For each card, draw or glue a picture of the tree on one side & write the description on the other.
- A Big maple tree with some dead branches (2)
- A maple tree with a small crown (2)
- A maple sapling (2)
- A maple seedling (2)
- A young healthy maple (2)
- A large crowned maple tree (2)
- A standing dead tree
- A big healthy oak tree
- A small shagbark hickory tree
- A young beech tree
- An old beech tree
- An old pine tree
- A healthy white birch tree
- A small basswood tree



Subject: Science

NH Standards:

Goal: Students will use inquiry strategies to investigate and understand the natural world.

Strand 1: sps1:2:1.1 sps1:2:1.2 sps1:2:1.4

sps1:4:1.2 sps1:4:1.4 sps1:4:1.7

Strand 2: sps2:2:4.3 sps2:2:5.1 sps2:2:5.2 sps2:4:4.2

Objectives:

*Students will learn how a forest can be turned into a productive sugar bush by considering and altering various factors important to tree growth.

Grade Level: Grade 3 - 6

Materials: Tree Identification Cards

Length of Lesson: 20 minutes

Activity:

1. Although the maple sugaring season occurs only in early spring (late February through early April), a maple sugar maker works throughout the year to prepare for the season. Explain to the students that they will be doing an activity to discover what these sugar makers need to consider to help the maple trees in their forest produce the most sap.

2. Choose one or two students to be the sugar makers. Explain that they just bought land and need to survey their new forest. Set the forest boundaries in the classroom within an area of approximately 12-15 square feet. Describe the forest as having several different sizes of trees growing close together. The remaining students will play the role of the trees. Have the students arrange themselves as trees within the forest boundaries.

3. Introduce yourself as a forester who can help the sugar makers learn how to manage their forest as a sugar bush. Ask the trees to name five things they need in order to grow well (sun, soil, water and space). Visit each tree and randomly hang a tree identification card around his or her neck. Each card identifies the tree and describes its age, health and growth. One by one, the trees can introduce themselves using this information.

LESSON #2– Maple Unit

Fit To Be Thinned - Continued

4. Explain that maple trees with wide spreading branches produce the most sap. Trees with wide spreading branches are said to have **Big Crowns**. Have the trees raise their branches (arms) in the air to check the size of their crown. Do any of the trees touch one another? What resources are they competing for? (sunlight and space)
5. How can the sugar makers improve sap production and help the trees develop large crowns? (If they remove some of the trees, they will reduce competition for sunlight and space.) Explain that this process of removing trees is called **Selective Cutting**, or **Thinning**, and is an important forest management technique. Compare cutting trees to thinning and weeding the garden. Remind the sugar makers that the decision to cut should take into consideration several factors, including the tree's present health, type and age. What would happen if too many trees were thinned out? Too few? Point out the importance of nurturing young trees and planting new ones so that the forest can regenerate over the years.
6. Have the sugar makers visit each tree. Through careful observation of the tree and its neighbors, they need to decide whether or not it should be cut. Have them pretend to cut down chosen trees. As trees are cut down, ask them to move to the area designated as the woodpile.
7. Once the sugar bush is thinned, ask the students how it might change over the years and how they will manage it.

Extensions: (These are shorter, less involved follow up lessons)

- A. Discuss the fact that some trees are sweeter than others. It takes less sap from these trees to make syrup. Show the class the Maple Math (attached) and have them calculate the number of gallons of sap needed for trees with different sugar concentrations.
- B. Discuss the various parts of the maple tree and their functions in tree growth and making sap. Diagram of the inner tree is attached. Try to locate cross sections of a 6-8" diameter log and let the children see the different growth rings and how to determine age of a tree.

Books: Gerstein, Mordecai. *Anytime Mapleson and the Hungry Bears*—Harper and Row, 1990.

Russell, Solveig P. *Sugaring Time*. Abingdon Press, 1961

Watson, Nancy D. *Sugar on Snow*. New York, New York: The Viking Press, 1964

LESSON # 2 - Fit To be Thinned

TEACHER BACKGROUND SHEET

The Sugar Maple: A Syrup Factory



A sugar maple should grow for forty years before the first sap is taken from it. The tree must grow for another forty years before it will produce its greatest amount of sap. The amount of sap each tree produces is dependent upon the size, condition and the crown area of the tree, the condition of the forest floor, and the weather. Usually an average sized tree produces about 130 litres of sap each season. For a tree to be a producer, it must be at least 80 cm in circumference. The size of the tree determines the number of tapholes to bore. The larger the circumference of the tree the greater the number of tapholes that can be made. Over tapping can seriously damage a tree.

Not all trees of equal size yield equal amounts of sap. The amount varies from year to year depending mainly upon the weather, particularly, the amount of sunlight that reached the leaves the year before. The warm sunny days and cold nights of early Spring are favoured for best sap production. Trees with large, leafy crowns are best able to produce the sugar required in maple syrup making.

Sap is a clear, colourless, and odourless liquid. Its composition is 96% water, 2 - 3% sugar, and 1% mineral salts. The minerals enter into the tree by the maple tree's roots absorbing water containing dissolved mineral salts from the ground through root hairs. Some of the minerals are magnesium, calcium, potassium, phosphorus, and nitrogen. Sap, which is mostly water, is the chief medium in plants in which nourishment is carried from one part of the organism to another. Therefore, sap serves as a medium for further actions to take place. For example, growth and development of the cell nucleus, cell tissues, etc.

Throughout the majority of the Winter months the sap is stored as a liquid in the roots of the tree. In order for the sap to move up the tree, it moves from the cortical cells of the roots to the xylem cells in the tree trunk. It is not known exactly how sap moves up the tree, but it is believed that osmosis (the movement of water from a high concentration area to that of low concentration) plays a strong part in this process.

The sap from some trees is much sweeter than that from others. The sweeter the sap, the higher its sugar concentration and the less of it required to produce syrup.

LESSON # 2 - Fit To be Thinned

TEACHER BACKGROUND SHEET

MAPLE MATH

The number of gallons of sap needed to make a gallon of syrup varies with the sugar content of the tree. Using a special instrument called a **sap refractometer**, a sugar maker can determine the sugar content of maple trees in the sugar bush. By using the Jones Rule of 86, he or she then can calculate the amount of sap needed to produce a gallon of syrup. Simply divide 86 by the % sugar concentration to determine the number of gallons of sap needed.

The average sugar concentration of maple trees is 2%. Using the formula: $86 \div 2 = 43$. Rounded off, this is the standard figure of 40 gallons used as the sap to syrup ratio. As the sugar concentration of trees increases, the amount of time and fuel needed to make the syrup decreases. As you can guess, trees with high sugar concentrations are highly desirable. Researchers have been working at the Proctor Maple Research Lab in Underhill, Vermont to clone sweet sap trees so that someday a whole sweet sugar bush can be planted. The sweetest tree on record is in St. Johnsbury VT. With a sugar concentration of 10%! How many gallons of sap are needed to make a gallon syrup from this tree?



THE MAPLE RULE

“How many gallons of sap are needed to make a gallon of syrup?”

You ask me how the problem's solved
It is easy, all you do
Divide the number eighty six
By sugar content true

Thus three percent takes twenty nine
And five but seventeen
The average say is two percent
Takes forty three is seen

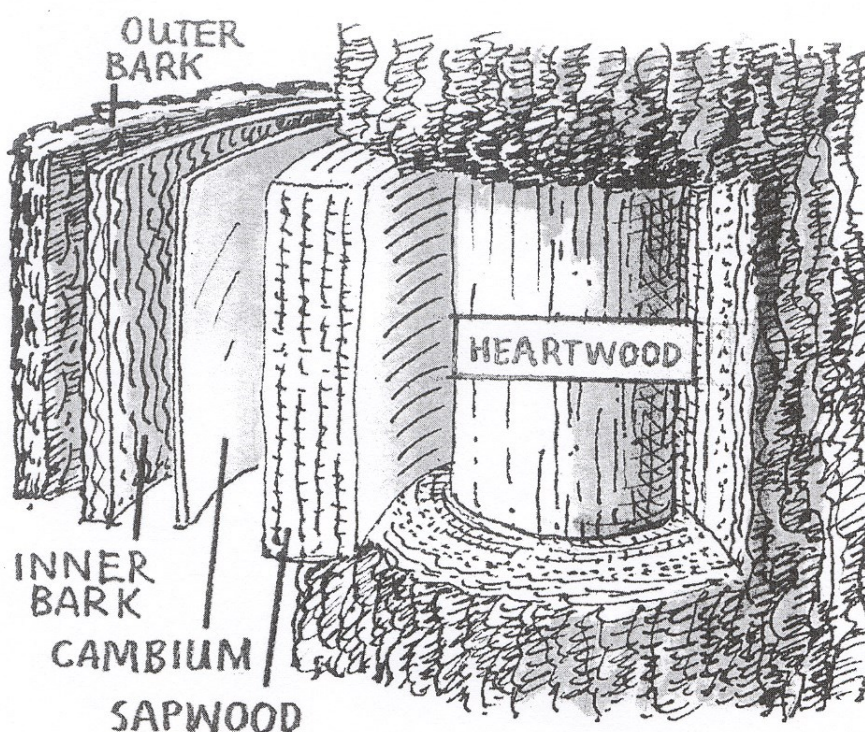
The richer the sap without a doubt
Will save you many a dime
In quality and fuel cost
Not to mention boiling time

-an excerpt from
“The Maple Rule of Eight-Six”
by C.H. Jones.

LESSON # 2 - Maple Unit

TEACHER BACKGROUND SHEET

The Inside Story



The first layer of the tree is the **OUTER BARK**. The outer bark is the tree's skin. It protects the tree from injury and disease. It is made of dead **phloem** cells that split and shift in various patterns. Each type of tree has its own special bark pattern.

The second layer is the **INNER BARK**. Just like your digestive system, it is for food transport. The inner bark is green and made of live **phloem** cells. These cells are full of sugars which they carry throughout the tree. The sugars are made in the leaves by the process **photosynthesis**.

The third layer is the **CAMBIUM**, and it is invisible. Well, not really, but you need a microscope to see it, because the cambium is only two cell layers thick. Each growing season, the cambium makes new sapwood or **xylem** cells which form the rings you see in the wood. It also makes new inner bark or **phloem** cells.

The fourth layer is the **SAPWOOD**. Minerals and water go up and down and all around in the sapwood. The sapwood has thick-walled cells that are like the plumbing system or veins of the tree. The sapwood is the new wood or **xylem** of the tree.

At the center of the tree is the dead **HEARTWOOD**. The heartwood is usually strong, and it provides the tree's support. The heartwood is dead sapwood. The cells no longer carry water and minerals throughout the tree because they are plugged up with a thick resin-like substance. Heartwood is often darker in color than the young sapwood.



MAPLE SUGARING CROSSWORD PUZZLE



ACROSS

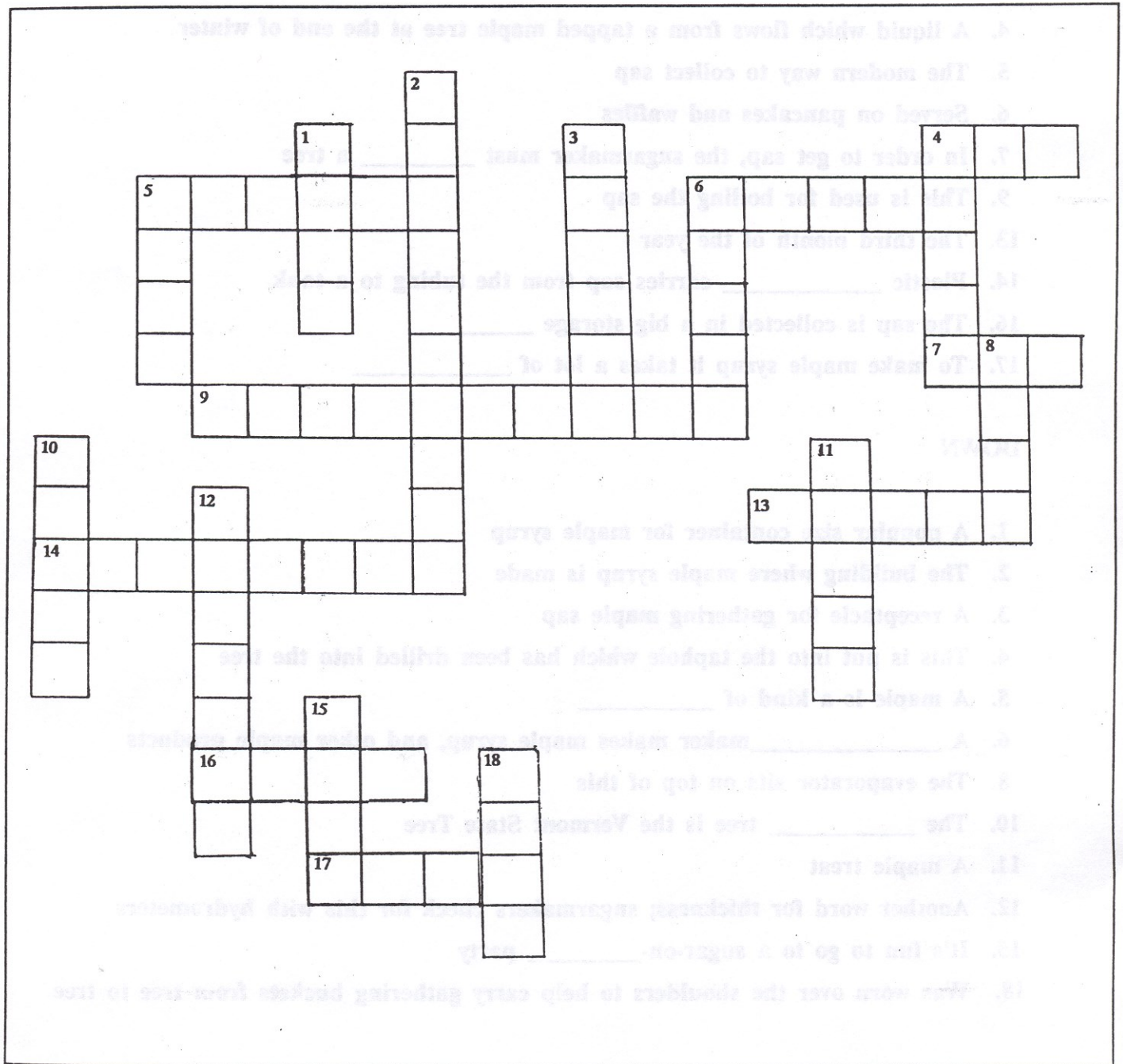
4. A liquid which flows from a tapped maple tree at the end of winter
5. The modern way to collect sap
6. Served on pancakes and waffles
7. In order to get sap, the sugarmaker must _____ a tree
9. This is used for boiling the sap
13. The third month of the year
14. Plastic _____ carries sap from the tubing to a tank
16. The sap is collected in a big storage _____
17. To make maple syrup it takes a lot of _____

DOWN

1. A popular size container for maple syrup
2. The building where maple syrup is made
3. A receptacle for gathering maple sap
4. This is put into the taphole which has been drilled into the tree
5. A maple is a kind of _____
6. A _____ maker makes maple syrup, and other maple products
8. The evaporator sits on top of this
10. The _____ tree is the Vermont State Tree
11. A maple treat
12. Another word for thickness; sugarmakers check for this with hydrometers
15. It's fun to go to a sugar-on-_____ party
18. Was worn over the shoulders to help carry gathering buckets from tree to tree



MAPLE SUGARING CROSSWORD PUZZLE





MAPLE SUGARING WORD SEARCH



Look for and circle the following words. They may go across, up and down, diagonally or backwards. Good luck!

maple
sugar
spout
sap

bucket
sugarhouse
tap
evaporator

mainline
pipeline
syrup
candy

tree
tank
Vermont
snow

hydrometer
arch
spile
tubing

E	X	M	O	S	T	Y	Z	Q	L	E	E	M	T	S	T	R	O
I	V	L	K	N	M	I	O	H	Y	D	R	O	M	E	T	E	R
W	C	A	N	D	Y	Z	L	O	A	C	R	D	W	S	K	I	A
M	Q	S	P	I	L	E	W	F	S	L	S	N	O	O	S	A	E
E	E	L	B	O	D	I	M	K	Y	B	U	C	K	E	T	R	A
W	S	B	C	R	R	A	W	Q	R	B	G	H	L	O	R	M	N
A	X	E	R	O	M	A	B	L	U	X	A	C	C	F	E	I	T
C	B	F	E	H	G	M	T	A	P	L	R	O	N	Q	E	P	R
E	L	C	E	F	C	D	A	O	B	Z	Y	X	V	W	T	U	S
G	B	A	D	C	S	U	G	A	R	H	O	U	S	E	D	F	X
I	U	T	V	E	P	L	E	C	U	S	P	Q	M	L	O	N	M
K	A	B	E	X	O	Y	G	K	M	F	H	S	A	P	S	U	L
L	S	R	R	O	U	F	M	S	P	N	K	F	A	A	G	I	J
N	O	O	M	Q	T	I	E	N	I	L	N	I	A	M	B	A	C
P	R	T	O	A	U	Q	W	O	P	T	E	E	R	A	L	B	M
R	A	A	N	B	C	F	O	W	E	P	Q	N	C	X	I	X	B
T	B	K	T	C	L	M	O	P	L	Q	U	L	H	I	F	W	S
V	P	M	U	J	W	R	K	F	I	M	L	O	P	F	G	I	X
X	S	O	P	C	I	D	K	G	N	I	B	U	T	H	O	M	P
Z	O	G	A	D	M	A	R	F	E	N	I	A	B	C	O	G	L

LESSON #3 MAPLE UNIT

ABC Sugarbush

Adapted by NHAITC from ABC Farm-OK AITC

Subject: Language Arts

Objectives: Students will learn to use the process approach to writing coherently, using appropriate conventions.

Overview: Students will find the maple terms in the word puzzle, then arrange them in alphabetical order at the bottom of the page.

Grade Level - 1-2

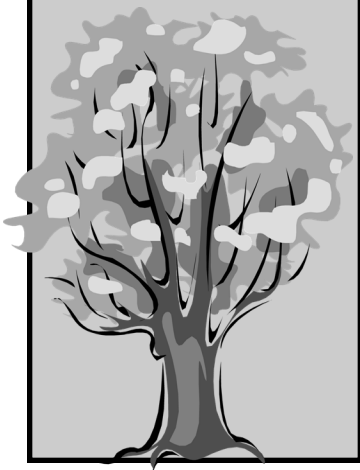
Length of Lesson: 20 - 30 minutes

Activity:

1. Review alphabetical order with your class.
2. Hand out student worksheets and read aloud the eight maple terms on the left and right sides of the page.

Materials:

- ABC Sugarbush Spring Worksheet



3. Have the students find and circle the maple terms in the puzzle and arrange them in alphabetical order at the bottom of the worksheet.

Teacher Background:

The order of the seasons determines how syrup will flow or not flow. Sugar makers have a specific order they use in order to make sap into syrup. After reading the story “Sugarbush Spring” the children will have heard about that special order of jobs and who does what. Spend a few moments discussing order in nature and in their day to day world.

Name: _____

ABC SUGARBUSH

Circle these words in the puzzle.

GALLON

HEAT

DRILL

COLLECT

B G A L L O N

U O P E A T M

C O L L E C T

K D R I L A P

E R L T E R L

T I A H C O E

F L A V O R Y

M L A P R O N

FLAVOR

EAT

APRON

BUCKET

Write the words in ABC Order.

A: _____

E: _____

B: _____

F: _____

C: _____

G: _____

D: _____

H: _____